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CANADIAN PATENT

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LIQUID INJECTION PROJECTILE

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Canada

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A B S T R A C T

A projectile for use in injecting a drug into an animal by means of a passive injection system. The projectile comprises a shaft, a separate head piece having a sharpened tip and being adapted to carry an injectable drug, and a frangible means securing the head piece to the shaft. When the projectile hits a target animal, the head piece, having a drug absorbed therein, pierces the animal's flesh, whilst the larger diameter shaft bounces off and severs the frangible means. This allows the shaft to fall away, leaving only the head piece embedded. The drug is released by diffusion from the embedded head piece into the animal's flesh.

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This invention relates to a projectile for use in injecting a drug into an animal.

Previously known devices of this type have suffered from the disadvantages that they require moving parts in order to secure release of the drug, and that the tip or head of the projectile remains attached to the shaft after impact with the animal's flesh. For instance, the type disclosed in United States Patent No. 2,854,925 (issued October 7, 1958 to Jack A. Crockford, et al) incorporates a means, actuated by firing the projectile, for causing a plurality of gas-producing reactants to intermix so as to move a propelling member forwards and drive the drug out in the animal's flesh. Similarly, the type disclosed in United States Patent No. 3,066,940 (issued December 4, 1962 to Melvin D. De Lorais) has the drug contained in a disruptable pellet or capsule which is ruptured upon impact with the animal by being thrust forward against a cutting blade. United States Patent No. 3,565,435 (issued February 23, 1971 to Fred B. Bear) describes a projectile in which a drug powder is contained in a cavity covered by a sheath, this sheath being moved back to release the drug as the head of the projectile enters the animal's flesh. Similar projectiles, using moving parts such as sliding or telescoping members, are disclosed in United States Patent Nos. 2,995,373 (issued August 8, 1961 to J.R. Cox) and 3,457,921 (issued July 29, 1969 to R.B. Waldeisen). None of these previously known devices uses a passive injection system, but rather they all carry the drug in some type of sealed compartment from which it is released by the action of a moving part. In this way they all suffer from the disadvantage that the relative movement of the parts, whether powered by inertial devices, springs or explosives, tends to be affected by the resiliency of the target surface, so that uniformity of performance cannot readily be achieved. Furthermore, they suffer from the additional disadvantage that the tip or arrow-head of the projectile remains attached to the shaft after implantation and this is inconvenient since it may cause the device to fall out or it may enable the animal to



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pull or shake it out before sufficient drug has been absorbed. Also the prior art devices tend to be large and to use relatively large quantities of the drug, to be complex in design, and to have poor ballistic properties.

The injection projectile of this invention overcomes these disadvantages in that it uses a passive injection system i.e. there are no moving parts involved, and in that the head of the projectile breaks off on impact with the animal, allowing the shaft to fall away and leave only the head piece embedded in the animal's flesh. In particular, the injection projectile of this invention comprises a shaft, a separate head piece having a sharpened end tip which is adapted to carry an injectable drug, and a frangible means securing the head piece to the shaft.

In a preferred embodiment the invention provides an injection projectile comprising a shaft, a cylindrical head piece made of porous material capable of absorbing and retaining a liquid drug, a frangible means securing one end of the head piece to the shaft, and a sharpened tip member rigidly secured to the opposite end of the head piece remote from the frangible means, whereby upon impact of the projectile with an animal the frangible means severs and the head piece is left embedded in the animal's flesh.

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The head piece may suitably be made from ^{fritted} ~~fretted~~ glass, porous plastic (including water soluble plastic), or sintered metal, such as sintered bronze, sintered nickel or sintered silver. The porous material of the head piece preferably has a pore size of from 15 to 50 microns. This material will retain a liquid drug through capillary effects during launch and impact, but will release it by diffusion into the animal's flesh. This has been demonstrated in tests in which 20 - 25 microlitres of drug solution have been injected into various animals using the injection projectile of the invention. The time required for immobilization of the animal may vary from a few seconds to several hours depending on the type and quantity of drug used, the type of animal and where the animal is hit. Preferably the head piece has a roughened outer surface to pre-

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vent it from being pulled out when the shaft breaks away.

It is also within the scope of the invention to use, as the head piece, an appropriately shaped, hardened cake of the drug, which would be released gradually into the animal's body. In this case, the drug may be used alone or in association with a physiologically acceptable carrier material.

In order to ensure penetration into the animal's flesh, the porous head piece may either be fitted with a separate sharpened end tip, or the forward end of the head piece itself may be sharpened. If a separate end tip is used, it may suitably be made from any hard material, such as a metal or hard
10 plastic.

The end of the head piece remote from the sharpened tip is secured to the shaft of the projectile by a frangible means. By frangible means there is meant a means that will sever upon impact with the target, either by breaking or being pulled apart, to release the shaft from the head piece. This frangible means may take the form of a short pin of compressible material, such as wood, or plastic, one end of which is pushed into a hole having a slightly smaller diameter than that of the pin, in the end of the cylindrical head piece remote from the sharpened tip, and the other end of the pin is pushed into a corresponding hole in the forward end of the shaft. In this way, the shaft and head piece
20 are held firmly together. When the projectile hits a target animal, the head piece enters the animal's flesh, whilst the main body or shaft of the projectile tends to bounce away from the animal's body. This bouncing away of the shaft causes the frangible pin to either break or be pulled out of one of the above mentioned holes, thereby separating the head piece from the shaft. When this occurs, the shaft falls away, leaving the head piece embedded in the animal's flesh.

The shaft may be aerodynamically designed and made from any suitable, relatively lightweight material, such as a metal or plastic. In a preferred embodiment the shaft is made of a mass stabilized plastic material, such as

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polyethylene. By mass stabilized is meant the provision of a heavy mass at the forward end of the shaft adjacent to the head piece, so as to ensure the projectile has good ballistic properties. The projectile flies well and may be launched by a conventional air (CO₂) gun or fired by a bow.

In a preferred embodiment, the shaft incorporates, at its forward end, an axially disposed cylindrical abutment or nose piece. In this embodiment, it is this abutment that is attached to the head piece by means of the frangible pin. Preferably the cylindrical abutment and cylindrical head piece have substantially the same diameter, this diameter being approximately one fifth the diameter of the shaft.

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It is desirable that the peripheral edge of the forward end of the shaft adjacent to the abutment should be rounded as this enables successful implantations to occur from angles of incidence of up to 30° from normal.

The injection projectile of the invention may be sold with or without a drug absorbed in the porous head piece. Take-up of a drug by the head piece is normally done by placing the porous head piece in a flexible but tight-fitting plastic tube, one end of which is attached to a syringe. The drug solution is then drawn through the porous head piece by operation of the syringe. In this way, saturation of the porous head piece with the drug solution is ensured. With reasonable quality control, the liquid-carrying volume of the porous head piece is quite reproducible. Thus, the quantity of drug solution used can be gauged with accuracy. The amount of the active drug employed can be varied by the use of porous head pieces having different capacities, or by varying the concentration of the drug solution. Obviously these factors will vary depending on the size of the animal to be injected.

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Pre-filled porous head pieces may be packaged and sold in plastic tubing, which is then removed just prior to use.

Suitable drugs which may be administered by use of the projectile include anaesthetics, such as intramuscular barbiturates, and a wide variety of

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other drugs, such as tranquilizers, diagnostic agents, sedatives, analgesics, antitussives, and antibacterial, antiprotozoal, antimetazoal and antifungal agents.

The injection projectile can be used for immobilizing cattle, zoo animals and hunted animals.

The drawing shows an enlarged (scale approximately 3:1) cross section of an example embodiment of the injection projectile of the invention.

The projectile illustrated comprises a polyethylene shaft 1, having a hollow rear portion 2 and a solid forward portion 3. The peripheral edge or shoulder 3a of forward portion 3 is rounded. The shaft 1 is mass stabilized, so as to ensure good ballistic properties, by the provision of a heavy metal ring 4 in the forward portion 3. The core 5 of metal ring 4 is threaded and receives the threaded end 6 of a cylindrical metal nose member 7, which is rigidly secured in the forward portion 3 of shaft 1. The end of the member 7 remote from the threaded end 6 extends forwardly at 8 to form a cylindrical abutment which incorporates a cylindrical hole 9.

A cylindrical porous head piece 10 is secured to the abutment 8 by means of a frangible wooden pin 11. This wooden pin 11 is of marginally greater diameter than the diameter of a hole 12 in head piece 10 and hole 9 in cylindrical abutment 8. As wood is compressible, the pin 11 may be pushed into these holes 9 and 12 to give a tight, secure fit.

A sharpened end tip member 13 is rigidly secured to the forward end of head piece 10.

For operation, the porous head piece 10 is first filled with a drug solution in the manner described above. The filled head piece is then secured to the shaft by means of pin 11.

The projectile may then be fired by gun or bow at the desired animal. The muscular area of the hindquarters is generally the most effective target. Upon impact with the target, the sharpened tip 13 and head piece 10 penetrate

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the animal's flesh. However, the shaft 1, being of much greater diameter than the head piece 10, tends to bounce off the target and in doing so causes the pin 11 either to break at the junction 14 between the shaft and the head piece, or to be pulled out from one of the holes 9 or 12. This allows the shaft 1 to fall away, leaving the head piece 10 embedded in the animal's flesh. The drug in the head piece 10 is then released by diffusion into the animal's flesh.

From the above description it can be seen that this invention provides a simple, efficient and relatively inexpensive injection projectile, which enables effective quantities of drugs to be administered to animals. The projectile is small and compact, has good ballistic properties, and does not involve the use of any moving parts in order to secure the release of the drug.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An injection projectile comprising a shaft, a separate head piece having a sharpened end tip and being adapted to carry an injectable drug, and a frangible means securing the head piece to the shaft, in such a manner that upon impact of the projectile with an animal, the frangible means severs and the head piece is left embedded in the animal's flesh.
2. An injection projectile as claimed in claim 1 wherein said head piece is made of rigid porous material.
3. An injection projectile comprising a shaft, a cylindrical head piece made of porous material capable of absorbing and retaining a liquid drug, a frangible means securing one end of the head piece to the shaft, and a sharpened tip member rigidly secured to the opposite end of the head piece remote from the frangible means, in such a manner that upon impact of the projectile with an animal the frangible means severs and the head piece is left embedded in the animal's flesh.
4. An injection projectile as claimed in claim 3 wherein the porous head piece includes an absorbed drug and is, when embedded, capable of releasing said absorbed drug into the animal's flesh.
5. An injection projectile as claimed in claim 4 wherein the frangible means is an axially mounted shear pin.
6. An injection projectile as claimed in claim 5 wherein the pin is a wooden pin.
7. An injection projectile as claimed in claim 5 wherein the shaft is cylindrical and at its forward end incorporates an axially disposed cylindrical abutment, and wherein said frangible pin secures the head piece to said abutment.

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8. An injection projectile as claimed in claim 7 wherein the cylindrical abutment and cylindrical head piece have substantially the same diameter, and wherein the ratio of said diameter to the diameter of the shaft is approximately 1:5.
9. An injection projectile as claimed in claim 7 or 8 wherein the peripheral edge of the forward end of the shaft adjacent said abutment is rounded.
10. An injection projectile as claimed in claim 2, 3 or 7 wherein said head piece is made of a material selected from the group consisting of sintered metal, fritted glass and porous plastic.
11. An injection projectile as claimed in claim 2, 3 or 7 wherein said head piece is made of a sintered metal selected from the group consisting of sintered bronze, sintered nickel and sintered silver.
12. An injection projectile as claimed in claim 2, 3 or 7 wherein said head piece is made of a material selected from the group consisting of sintered metal, fritted glass and porous plastic, said material having a pore size of from 15 to 50 microns, and wherein the outer surface of said head piece is roughened.
13. An injection projectile as claimed in claim 2, 3 or 7 wherein the shaft is a mass stabilized polyethylene shaft.
14. An injection projectile comprising a shaft, a separate head piece having a sharpened end tip; and a frangible means securing the head piece to the shaft, in such a manner that upon impact of the projectile with an animal, the frangible means severs and the head piece is left embedded in the animal's flesh, said head piece comprising a cylindrical, hardened cake of an injectable drug, associated, whererequired, with a physiologically acceptable carrier material.

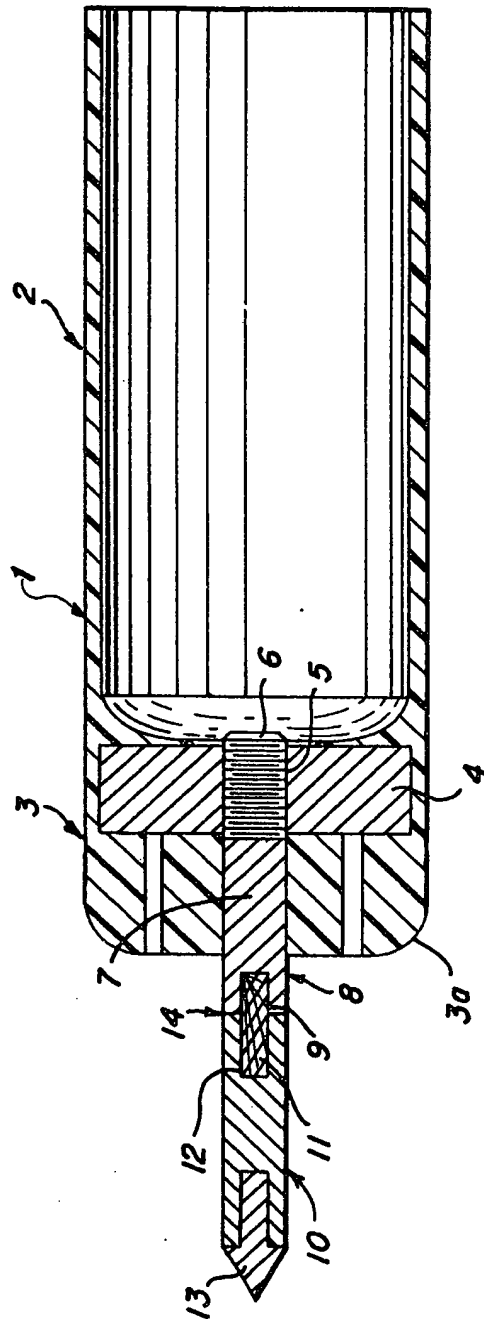
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15. An injection projectile as claimed in claim 5 wherein the shaft is cylindrical and has a hollow rear portion and a solid, weighted forward portion.

16. An injection projectile as claimed in claim 15 wherein an axially disposed cylindrical nose member is rigidly secured in said forward portion and wherein the frangible pin secures the head piece to the forward end of said nose member.



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